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From: Cindy F. Kleiman, Lockheed Martin/REAC

Subject: Concentrations of Metals and PCBs in Tissues of Rabbits, Squirrels and Turkeys

A literature search was conducted to evaluate concentrations of metals, polychlorinated biphenyls (PCBs) and polynuclear aromatic hydrocarbons (PAHs) in tissues from rabbits, squirrels and turkeys. No relevant information was found for PAHs. Metals and PCBs data are summarized below and in the attached tables.

Rabbit - Metals

Krelowska-Kulas et al. 1994
Objective/Methods: The purpose of the study was to determine the metals concentration in rabbit internal organs and muscle. The experimental group consisted of 180 New Zealand white and black-white rabbits from Crakow, Poland; the control group consisted of 180 rabbits from a non-industrial area. Kidneys, liver, heart and haunch muscle were analyzed for lead, cadmium, iron, copper, zinc, manganese and magnesium.
Results: Significant differences in organ and muscle concentrations between the experimental and control groups were found for lead and cadmium. Significant differences between groups were also found for iron (kidney and muscle), zinc and copper (kidney, heart, muscle). No significant differences between groups were found for manganese or magnesium. Tissue concentrations are presented in Table 1.

Massanyi et al. 1995
Objective/Methods: To study the distribution of cadmium in the body following acute and chronic administration, hybrid Hyla rabbits were divided into groups of eight. Group A received a single cadmium dose (1.5 milligrams per kilogram [mg/kg]) by intraperitoneal injection. Groups B and C received daily doses of 1 mg/kg, given in the diet for five months. Group C rabbits were then fed a normal diet for seven months before sacrifice. Control rabbits received no cadmium. Ovaries, uterus, testes, liver, kidney and muscle were collected from all rabbits.
Results: In general, the highest tissue cadmium concentrations were observed after acute administration, with the liver containing the maximum concentration (41.31 mg/kg). The one exception was the kidney, which had a cadmium concentration of 53.99 mg/kg after chronic administration versus 31.63 mg/kg following acute administration. Cadmium levels remained elevated in liver and kidney even after chronic administration was followed by seven months of a regular diet (3.7 mg/kg and 22.5 mg/kg in liver and kidney, respectively). In the uterus, the concentration of cadmium actually rose after seven months of normal diet, going from 0.25 mg/kg after chronic dosing, to 0.33 mg/kg after seven months of a normal diet, but this was not statistically significant.

Gerken and Swartout 1986

Objective/Methods: This study was intended to determine blood lead concentrations in healthy rabbits from various environments. Blood was obtained from 15 laboratory rabbits housed in cages, 45 rabbits raised for meat and housed in outdoors in wire hutches, and 8 pet rabbits kept unrestrained in homes. The mean and minimum-maximum blood lead concentrations for these three groups were 9.7 micrograms per deciliter (ug/dL) (6-22), 9 ug/dL (2-27), and 6.8 ug/dL (5-10), respectively. There were no significant differences among groups. The overall mean and range of blood lead was 8.9 ug/dL (2-27). These levels are in agreement with previously reported concentrations in laboratory rabbits, and indicate that different environments do not affect blood lead in healthy rabbits.

Ahn et al. 1995

Objective/Methods: This study was designed to determine the effects that fluorine and aluminum have on each other's bioavailability and tissue accumulation. Adult male New Zealand White rabbits (n=3 per group), were given fluoride (F) alone (three dose groups), aluminum (Al) alone (two dose groups), or F plus Al (six dose combinations), in drinking water. Controls received neither. After ten weeks, plasma, heart, liver, incisors and tibia (without marrow) were collected.
Results: Plasma Al values were not significantly raised above control values (mean 0.03 ug/mL) regardless of treatment. In liver, no significant Al accumulation was seen at any dose. The mean control level was approximately 4 micrograms per gram (ug/g) (from bar graph). Addition of Al alone to drinking water did not significantly increase the concentration of Al in the tibia above control levels (approximately 20 ug/g-ash – from bar graph); however, Al accumulated in the bone at increasing doses of F, becoming significant at 50 ppm F in drinking water. A similar effect was observed in sterna obtained from a two-year rat study, with Al accumulating in the presence of F, even when Al was not administered to the animals.
Conclusions: Al did not bioaccumulate in rabbits when given alone, even at doses of 500 ppm in drinking water; however, co-administration of F caused a significant dose-dependent increase in Al accumulation in bone.

Bersenyi et al. 1999

Objective/Methods: To study the bioaccumulation of metals from carrots, 15 male and 15 female New Zealand White rabbits were divided into six groups. The control group received a standard diet, while the five treatment groups received a restricted standard diet supplemented with carrots grown in soil heavily contaminated with either molybedenum (Mo), cadmium (Cd), mercury (Hg), lead (Pb) or selenium (Se). Urine and feces were collected. After 20 days, blood samples were obtained for serum enzyme analysis (not summarized here). Animals were sacrificed and various organs were obtained for chemical and histological analysis (not summarized here). The highest metal concentrations were obtained for the following organs: kidney (Mo: 3.46 parts per million [ppm]; Cd: 2.59 ppm; Pb: 4.66 ppm; Hg: 50.48 ppm) and liver (Se: 64.95 ppm). Corresponding concentrations in control animal kidney were: 0.75 ppm (Mo), 1.12 ppm (Cd), 0.04 ppm (Pb), nd (Hg). The Se concentration in the control animal livers was 1.74 ppm. Metal concentrations for other organs are provided in Table 1, below. After accounting for elimination in feces and urine, the retention rates in the body were as follows: 19.8% (Mo), 62.1%, (Cd), 33.6% (Pb), 35.4% (Hg) and 52.6% (Se).

Bersenyi et al. 2003

Objective/Methods: This study was designed to evaluate the effects of heavy metal ingestion on rabbit hematology and serum biochemistry. Twelve female New Zealand White rabbits were fed inorganic salts of lead, cadmium or mercury (four per treatment group) for 28 days. Venous blood samples were obtained on days zero and 28.

Results: On day zero (prior to dosing), serum concentrations of cadmium, mercury and lead were: <0.1 micrograms per liter (ug/L) (Cd and Hg) and 22.23 ug/L for Pb. On day 28, serum concentrations were 0.13 ug/L, 97.58 ug/L and 46.5 ug/L for Cd, Hg and Pb, respectively. The authors note that although serum lead doubled during the course of the experiment, the final concentrations were still within the range of mean blood lead reported elsewhere for healthy laboratory rabbits (20-270 ug/L). The study also evaluated various hematological and biochemical parameters, and liver and kidney histopathology for evidence of toxicity (not summarized here).

Chan et al. 2004

Objective/Methods: This study was designed to compare cadmium bioaccumulation in tissues of female New Zealand SPF rabbits fed lettuce grown in Cd-containing solutions ("incorporated"), lettuce sprayed with soluble Cd nitrate ("amended"), or control lettuce (no added Cd) with Cd administered by gavage. The first phase was a 16-day study in which rabbits were fed one of the three diets over a range of Cd concentrations, with kidneys and livers harvested on day 16. In the second phase, rabbits were fed one of the three diets at a fixed Cd concentration. Background tissue concentrations were obtained from three rabbits on day 1; thereafter, organs were harvested from two rabbits every two weeks for ten weeks.

Results of Phase 1: There was a positive relationship between delivered Cd dose and kidney Cd, but no marked difference among the diets; a regression pooling the data for all three diets fit as well as regressions for each diet separately. The regression was not linear, suggesting that at higher doses, either depuration increases or absorption decreases; furthermore, the relationships between dose and kidney concentration appeared to diverge at higher doses. Kidney concentrations of Cd in the "background" groups (those receiving no added Cd in lettuce or gavage) were 0.09 ug/g, 0.08 ug/g, and 0.06 ug/g for the incorporated, amended and gavage diets, respectively. Kidney cadmium concentrations in the highest dose groups were 0.38 ug/g, 0.76 ug/g and 0.8 ug/g, respectively. There was no relationship between dietary Cd dose and liver Cd. Diets did not differ significantly in zinc content (a known inhibitor of Cd absorption).

Results of Phase 2: In both kidney and liver, Cd concentrations increased as the cumulative dietary dose increased, for all three diets. The regression relationship between kidney Cd and dose for the amended diet was significantly different than the regressions for incorporated and control/gavage diets: kidneys accumulated Cd more readily from an amended diet than from an incorporated diet, over-predicting bioaccumulation in the kidney by one-third. Thus, the use of Cd amended diets to assess risks from dietary Cd may overestimate actual bioaccumulation of Cd from soil. The authors present several possible explanations for the greater degree of kidney accumulation of Cd from amended diets compared with incorporated diets, including the role of metallothionein-bound Cd. For liver, the Cd content was described as well by a single regression for all three diets pooled, as by regressions for each individual diet. No relationship was found between Cd in diet and Cd in bile, serum or urine.

Toman and Massanyi 1996

The maximum cadmium concentration found in the kidneys of five brown hare (*Lepus europaeus*), 2-3 years old, from a relatively unpolluted area of Slovakia was 2.05 mg/kg wet weight (ww). The maximum cadmium concentration in the liver was 0.36 mg/kg ww, and cadmium concentration in the testis was 0.007 mg/kg ww. In sixteen rabbits (*Oryctolagus cuniculus*), age one year, from a research institute in a relatively unpolluted area of Slovakia, the maximum cadmium concentrations in kidney, liver, testis, ovary and uterus were: 0.17, 0.04, 0.04, 0.03 and 0.04 mg/kg ww, respectively. This confirms other findings that cadmium bioaccumulates primarily in the kidney and liver. Findings of other investigators are also provided.

Falandysz 1991
Objective/Methods: Samples of rabbit muscle meat, liver and kidneys were taken from randomly selected healthy animals at slaughterhouses in northern Poland from 1984-86 and 1987.
Results: Concentrations of manganese, copper, zinc, iron, cadmium, mercury and lead are shown in Table 1, below.

Falandysz et al. 1994
Objective/Methods: Healthy rabbits were selected randomly from slaughterhouses and rabbit-rearing facilities in northern Poland during 1988-1991. Muscle, liver and kidney were analyzed for metals.
Results: Shown in Table 1, below.

Khan and Mielke 1998
Objective/Methods: Liver and kidney samples were taken from 25 rabbits killed by hunters in Alabama, 1995-96. Concentrations of lead, cadmium, copper, chromium, cobalt, nickel and zinc were reported for all rabbits and for male and female rabbits separately (see Table 1).
Results: Kidney concentrations of lead and cadmium were significantly higher in kidneys than in livers, and kidney lead was significantly higher in females than in males. Mercury levels were below detection. It should be noted that the liver lead concentrations for lead and cadmium in males and females are higher than the liver concentrations shown for all rabbits; this discrepancy is not discussed in the paper.

Nuurtamo et al. 1980
Objective/Methods: Meat samples were collected from two major slaughterhouse chains at five locations each in Finland from June to August 1975, and January to March 1976, to evaluate metal concentrations during the pasture and indoor feeding seasons, and evaluate exposures to Finnish consumers. Samples included beef, steer, pork, mutton, sheep, horse, moose, reindeer (various cuts and organ meats); chicken, hen, turkey, ptarmigan, and rabbit flesh; and various processed meat products.
Results: Samples were analyzed for metals, sodium, calcium, potassium, magnesium, phosphorus, fluorine, silicon and bromine. In the two samples of rabbit flesh, mercury concentrations were below the detection limit of 2 ug/kg ww; other metal results are shown in Table 1. Only one sample was analyzed for arsenic.

Rabbit - PCBs

Thomas et al. 1992
Objective/Methods: A review article summarizing data on contaminants (radionuclides, metals, hydrocarbons, organochlorines and PCBs) in the Arctic terrestrial ecosystem, including the Arctic hare (*Lepus arcticus*).
Results: Total PCB concentrations in fat, liver and muscle from female Arctic hares captured in the Arctic Bay area were 3.4 ug/kg, 1.4 ug/kg and 0.4 ug/kg ww, respectively. Hexachlorobiphenyls were predominant in fat, whereas tetrachlorobiphenyls and pentachlorobiphenyls predominated in liver and muscle.

Montesissa et al. 1992
Objective/Methods: To study the transfer of PCB congeners present in a commercial mixture (Fenclor 64) in rabbit milk following administration during pregnancy. Ten New Zealand White rabbits received a single intraperitoneal injection of 100 mg/kg Fenclor 64 in corn oil on pregnancy day 15, with ten control rabbits receiving an injection of corn oil. Four fetuses were obtained from each of two treated and two control dams on pregnancy day 28; the remaining rabbits gave birth, and on days 5, 10, 20 and 40 post-partum, two mothers from each group and

four of their offspring were sacrificed. Subcutaneous, perirenal, epiploic and pericardial adipose tissue from the mothers were analyzed for PCBs. Whole-body homogenates (minus liver) from fetuses and newborns, and whole-body homogenates (minus gastric contents) from the older offspring were analyzed for PCBs. The gastric contents were also analyzed, as an indicator of PCBs transferred via milk.
Results: Tissue extracts from the treated dams and their offspring contained congener peaks consistent with Fenclor 64. Tissue samples from controls were always below the method sensitivity limits. The total PCBs in the adipose tissue of dams sacrificed during pregnancy were similar to that of the fetuses (152.1 ug/g fat and 126.4 ug/g, respectively). At day 5 postpartum, newborn fat PCB levels (216.8 ug/g) were double those of the fetuses, and PCB levels in milk (reported as offspring gastric content) were similar to PCB levels in fat of dams sacrificed at the same time. PCB levels in fat in dams remained high for the duration of the study, dropping only to 95.5 ug/g by postpartum day 40. However, PCB levels in gastric contents (=milk) and in tissues of offspring dropped by postpartum day 20 by about 50% and 30%, respectively. At postpartum day 40, tissue levels had dropped to 36.2 ug/g.
Conclusion: PCBs given by injection during pregnancy passed across the placenta into fetal tissue, with fat levels approximating those of the mother. More PCBs reached the offspring via milk than via placental transfer, but this did not lead to depletion of maternal PCBs by postpartum day 40. Levels in offspring dropped by day 40 due to growth.

Squirrel - Metals

Allen-Gil et al. 1997
Objective/Methods: This study examined the concentrations of zinc, copper, cadmium, selenium, arsenic, nickel, lead and mercury in livers of Arctic ground squirrels trapped live at three locations in the foothills of the Brooks Range, Alaska. Whole livers were obtained from six squirrels; the remainder of the samples were taken by pinch biopsy, after which the squirrels were released at the location of capture.
Results: Mean concentrations of metals ranged from below detection to 32 ug/g ww (for zinc). No consistent patterns were observed for the three different sites, and there were no significant correlations between concentrations and percent body fat. Positive correlations were observed between concentrations of the different metals. The metal concentrations were similar to those reported for other North American arctic terrestrial herbivores.

Bench et al. 2001
Objective/Methods: The aim of the study was to demonstrate that olfactory uptake of manganese (Mn) and cadmium (Cd) in soil from the nose directly into the brain is a significant exposure route for burrowing mammals. The study also evaluated the accuracy of biotransfer factors previously developed for ground squirrels based on livestock data. Male California ground squirrels (*Spermophilus beecheyi*) were trapped at two locations (six squirrels per location) at the Lawrence Livermore National Laboratory Site 300 facility in California. One location ("B850") was highly contaminated with Mn and Cd, the other location ("WOP") less so. The olfactory bulbs, liver and left hind thigh muscle were collected and analyzed. Soil was also collected from these two locations. A comparison "nose-only exposure" study for Mn was also conducted in laboratory rats (data not summarized here) to evaluate the olfactory pathway.
Results: Soil and tissue concentrations of Mn and Cd are shown in Table 2, below. All squirrel olfactory bulbs showed measurable Mn and Cd, with higher levels than respective liver concentrations, and were correlated with Mn and Cd concentrations in soil. While systemic transport of Mn to the brain following soil ingestion could not be ruled out, Mn concentrations decreased with distance into the olfactory bulb. This suggests that Mn uptake via the olfactory route is a significant route of exposure. Cd uptake into the olfactory bulb also occurred, with the

olfactory bulb-to-soil concentration ratio about 500 times higher than the respective Mn:soil ratio. The authors calculated soil-to-tissue biotransfer factors of 0.44 for location B850, and 0.29 for WOP. These are substantially higher (approximately 1000-fold) than biotransfer factors for squirrels previously calculated for this site based on livestock exposure models (which consider inhalation to be a minor route of exposure, and do not consider olfactory uptake at all).
Conclusions: This study suggests that an exposure route not often evaluated in ecological risk assessments may be important for certain burrowing mammals.

Knopper et al. 2006
Objective/Methods: To determine if ingestion of shot Richardson's ground squirrels (RGS) would pose a hazard to scavenging hawks. Carcasses of 15 shot RGS were X-rayed, and bone, hair and tissue containing fragments adjacent to the path of the bullet were analyzed for lead. To determine background body burden, the left hind legs and haunch of two squirrels (areas containing no visible fragments) were also analyzed.
Results: The normal background body burden of lead from the hind legs was 0.01 mg. The median body burden in areas with visible fragments was 3.23 mg, ranging from 0.01 to 17.21 mg. The low end of the range (the same body burden as the hind leg sample) was from one squirrel with no visible bullet fragments. The authors concluded that scavenging hawks could be harmed by ingestion of shot RGS carcasses.

Pratt 1988
Objective/Methods: To examine the lead body burden of squirrels living adjacent to areas with differing traffic levels, 17 male and four female gray squirrels (*Sciurus carolinensis*) were live-trapped from two different sites in Pennsylvania. One site was a rural area with low vehicular traffic, the other a suburban area adjacent to a heavily traveled highway. The 10 squirrels from the suburban location were trapped in 1984, the 11 rural squirrels in 1984 and 1987. Hair samples were taken from the neck and hindquarters and analyzed for lead. Because lead does not accumulate in hair over time, concentrations in hair provide an indication of current (acute) exposure.
Results: A significantly lower (6.7-fold) concentration of lead was measured in hair from squirrels from the rural site compared with the suburban site. No significant difference was found by sex or by year of collection. Levels were comparable to or lower than lead concentrations in squirrel hair reported by other researchers.

McLaughlin et al. 1981
Mean lead levels in hair from Eastern gray squirrels (*Sciurus carolinensis*) trapped in rural and urban areas of Cumberland and York Counties, Pennsylvania, were 4.31 ppm dry weight (dw) (rural) and 11.79 ppm dw (urban); the differences between rural and urban concentrations were significant.

McKinnon et al. 1976
Objective/Methods: Gray squirrels (*Sciurus carolinensis*) were live-trapped from 36 collection sites in Jacksonville, FL during January-December 1974. Three sites per month were sampled (five squirrels per site), for a total of 180 squirrels. Twelve "control" squirrels were also shot in a wildlife management area on the Gulf Coast. Kidneys were analyzed for cadmium, lead and zinc.
Results: Kidney concentrations of lead and zinc were similar for all age groups. The mean leads from the Jacksonville squirrels were 0.47-1.32 ppm ww, whereas mean lead for the Gulf Coast squirrels were 0.2-0.26 ppm ww. Zinc means were 23.04 - 30.54 ppm ww, and 14.32 – 18.61 ppm ww for Jacksonville and Gulf Coast squirrels, respectively. For cadmium, kidney concentrations increased up to 2 years of age. The mean at 2 years was 14.93 ppm ww for the Jacksonville squirrels, compared with 4.63 ppm ww for the Gulf Coast squirrels. The differences

between the Jacksonville and Gulf Coast squirrels were significant for all three metals. The study also evaluated kidney metal concentrations of Jacksonville squirrels grouped by type of land use (residential/park/school/cemetery) and by human socioeconomic status (1970 census data) for each site. No differences were observed in mean concentrations grouped by land use. If four elevated lead data points (>3 ppm) are eliminated from consideration, it appears that kidneys of squirrels from the middle and high socioeconomic areas contained less lead than those from the low socioeconomic areas; however, when all data points are included, this pattern is not evident. Of the four sites with elevated kidney lead, a source could be determined for only one (elevated concentrations of lead in drinking water).

Goldsmith and Scanlon 1977
Objective/Methods: The purpose of this study was to determine the effect of different traffic densities on whole-body lead concentrations in small mammals (mice, shrews, voles, chipmunk, and the Southern flying squirrel, *Glaucomys volans*), earthworms and grasshoppers. The small mammals were collected in November 1974 from three control areas at least 500 meters (m) from the nearest road located within a national forest in Virginia, and from within 20 m of the roadway in three traffic areas with varying traffic densities in September-October 1974. Mammals were collected via baited snap-traps. Stomach contents were removed before whole-body analysis.
Results: Only two Southern flying squirrels were trapped, from the same control area. The mean whole-body lead concentration was 7.8 ug/g dw. These data could not be used for statistical analysis due to the small sample size.

Squirrel - PCBs

Allen-Gil et al. 1997
Objective/Methods: This study examined the levels of PCBs and other organochlorine compounds (not summarized here) in liver and fat from Arctic ground squirrels trapped live from three locations in the foothills of the Brooks Range, Alaska. Whole livers were obtained from six squirrels; the remainder of the liver samples were taken by pinch biopsy, after which the squirrels were released at the location of capture. Fat samples were collected from the abdominal and/or gonadal region.
Results: PCBs 138 and 170 were found in squirrel livers from all three locations. Other PCBs were found infrequently or not at all. There were no significant differences in concentrations by sex or by site. Concentrations of PCBs 138, 170 and 180 were positively correlated. In fat samples, PCBs 138 and 153 were most frequently found. Total PCBs in fat were negatively correlated with squirrel weight. Concentrations of individual PCBs are shown in Table 5. The concentration of total PCBs in squirrels were not elevated relative to herbivorous small mammals from other locations; however, the detection of PCBs in squirrels with a limited home range is evidence of the pervasiveness of PCBs in the environment.

Greichus and Dohman 1980
Objective/Methods: Following the discovery of high levels of PCBs in soil and corn leaves collected near two electrical transformer salvage companies in South Dakota, additional environmental samples were taken, including liver and muscle from the 13-lined ground squirrel (*Spermophilus tridecemlineatus*).
Results: PCBs in liver and muscle from squirrels ((number not indicated) collected near the factory area were 8.71 ppm and 2.89 ppm, respectively; corresponding levels from squirrels collected from an uncontaminated area in Brookings, SD, were 0.41-1.44 ppm (liver) and 0.72-0.86 ppm (muscle), indicating the occurrence of bioaccumulation related to factory discharges.

Turkey - Metals

Falandysz, J. 1991

Samples of turkey muscle meat, liver and kidneys were taken from randomly selected healthy turkeys at slaughterhouses in northern Poland in 1986 or 1987. Concentrations of manganese, copper, zinc, iron, cadmium, mercury and lead are shown in Table 3, below.

Falandysz et al. 1994

Objective/Methods: Healthy turkeys were selected randomly from slaughterhouses and poultry-rearing facilities in northern Poland during 1988-1991. Muscle, liver and kidney were analyzed for metals.
Results: Shown in Table 3, below.

Nuurtamo et al. 1980

Objective/Methods: Meat samples were collected from two major slaughterhouse chains at five locations each in Finland from June to August 1975, and January to March 1976, to evaluate metal concentrations during the pasture and indoor feeding seasons, and evaluate exposures to Finnish consumers. Samples included beef, steer, pork, mutton, sheep, horse, moose, reindeer (various cuts and organ meats); chicken, hen, turkey, ptarmigan, and rabbit flesh; and several processed meat products.
Results: Samples were analyzed for metals, sodium, calcium, potassium, magnesium, phosphorus, fluorine, silicon and bromine. In the two samples of turkey flesh, molybdenum (Mo), cobalt (Co), nickel (Ni), mercury (Hg), cadmium (Cd), lead (Pb) and arsenic (As) concentrations (only one sample was analyzed for As) were below their respective detection limits of: 0.1 mg/kg ww (Mo), 10 ug/kg ww (Co), 0.02 mg/kg ww (Ni), 2 ug/kg ww (Hg), 5 ug/kg ww (Cd), 20 ug/kg ww (Pb) and 0.02 mg/kg ww (As). Other results are shown in Table 3.

Richards 1989

Objective/Methods: One of the study objectives was to determine the effects of egg production on serum and liver trace elements. Egg production by twenty-five turkey hens was initiated by increasing the light cycle from six hours to 14 hours. Egg production began 2-3 weeks later and peaked at 5 weeks. At 0, 1, 5 and 15 weeks post-photostimulation, 5 laying hens were killed. Five non-laying hens were also killed at week 15.
Results: Serum levels of calcium (Ca), zinc (Zn), copper (Cu) and iron (Fe) significantly increased with the onset of egg production, fourfold for Ca, Zn and Cu, and more than 10-fold for Fe, and remained elevated through week 15, although Zn and Fe declined over time. Serum Ca, Zn and Fe in hens not laying at 15 weeks were not significantly different from values obtained before photostimulation (week 0). For laying hens, baseline (week 0) concentrations were 12.92 milligram percent (mg %) (Ca), 1.64 ug/mL (Zn), 0.12 ug/mL (Cu) and 1.37 ug/mL (Fe). The respective maximum concentrations were 40.6 mg% (week 15), 6.88 ug/mL (week 1), 0.55 ug/mL (week 1) and 14.26 ug/mL (week 1). The rise in serum Zn, Cu and Fe was accompanied by a decline in liver concentrations in the liver, dropping from concentrations of 75 ug/g (Zn), 15 ug/g (Cu) and 573 ug/g (Fe) at week 0 to 39 ug/g, 8 ug/g and 186 ug/g, respectively, at week 1. (Liver concentrations rose by week 15 almost to baseline levels among still-laying hens.)
Conclusion: There is a transfer of these metals from hepatic stores into the blood, and then into the yolk of the developing egg. A metalloprotein, vitellogenin, was hypothesized as a mediator of this transfer of trace elements. Dietary trace metals may play a role in determining the metal content of vitellogenin in the blood.

Glogowski et al. 2004

Objective/Methods: In a study designed to determine the effect of zinc (Zn) on semen from turkey toms, 27 Big-6 turkey toms were divided into three groups. The first group received a standard diet containing Zn at 34 mg/kg; groups II and II were also provided with an additional 60 mg/kg and 120 mg/kg of Zn. Blood was obtained prior to supplementation and then every six weeks for 24 weeks. Semen quantity, quality and biochemical indices (not summarized here) were also measured.

Results: Zn concentrations in serum did not change during the study and were not affected by the level of Zn in the diet. The range of serum Zn for all groups and collection periods was 1.93-2.71 ug/mL. This has also been found by other researchers.

Turkey - PCBs

Hansen et al. 1989

Objective and Methods: An investigation was conducted following a routine premarket screening that revealed the presence of PCB contamination in turkeys at levels greater than the FDA tolerance of 3 ppm. Turkey fat and building material samples were analyzed for PCBs.

Results: Two samplings of fat from 30 turkeys each had indicated PCB residues from below detection to 17 ppm. Further sampling of six fat samples each from turkeys from two range houses contained PCBs from non-detect to 5.1 ppm. The congener profile was consistent with that found in vapor seal/insulation material in the building, allowing for weathering and biodegradation, and was similar to a mixture of Aroclor 1254 and 1260.

Conclusion: Contamination resulted from turkeys eating pieces of vapor seal that had fallen from the ceiling.

Sandell and Kokkonen 2003

Methods: Market-obtained turkey samples (not otherwise described) were analyzed via GC-HRMS-SIM for PCBs, dioxins and furans.

Results: PCB concentrations, on a fresh weight basis, ranged from 1 picogram per gram (pg/g) (level of detection) for PCB-81, -114, -126 and -169, to 39 pg/g for PCB-118. Results corrected for lipid content ranged from 20 pg/g (detection limit) for PCB-81, -114, -126 and -169, to 893 pg/g for PCB-118.

Table 1: Rabbit - Metals

Species	Location	Number of Animals	Organ/Tissue	Chemical/Concentration	Reference
Healthy rabbits	Poland: Cracow (experimental group) and non-industrial area (control group)	180 per group	 Kidney Liver Heart Muscle	All concs in mg/kg “fresh matter”; control/experimental: Pb: 31/402 Cd: 2/32 Fe: 38.4/45.1 Cu: 2.6/6.6 Zn: 17/30.4 Mn: 0.55/0.57 Mg: 180/176 Pb: 18/260 Cd: 2/30 Fe: 28.5/69.2 Cu: 3.1/5.8 Zn: 14/41.3 Mn: 2.49/2.66 Mg: 232/230 Pb: 15/194 Cd: 2/21 Fe: 27/58.7 Cu: 3/5.9 Zn: 16.2/38.3 Mn: 0.87/0.88 Mg: 226/220 Pb: 6/54 Cd: 2/13 Fe: 10.8/22.5 Cu: 1.2/2.4 Zn: 13/23.6 Mn: 0.45/0.47 Mg: 264/269	Krelowska-Kulas et al. 1994

Table 1 (Cont'd)

Species	Location	Number of Animals	Organ/Tissue	Chemical/Concentration	Reference
Healthy rabbits	not given	15 (lab rabbits) 45 (raised for meat) 8 (pet rabbits) 68 (total)	Blood	Pb: 9.7 ug/dL (6-22) Pb: 9 ug/dL (2-27) Pb: 6.8 ug/dL (5-10) Pb: 8.9 ug/dL (2-27)	Gerken and Swartout 1986
Healthy rabbits	not given	not given	Blood	Pb: 4.5-37 ug/dL	Bartlett et al. 1974 as cited in Gerken and Swartout 1986
Rabbit	NA (lab study)	4 per group	Serum	Cd: <0.1 ug/L (day 0) 0.13 ug/L (day 28) Hg: <0.1 ug/L (day 0) 97.58 ug/L (day 28) Pb: 22.23 ug/L (day 0) 46.5 ug/L (day 28)	Bersenyi et al. 2003
Rabbit	NA (lab study)	5 per group	 Heart Lung Liver Kidney Spleen Adipose Muscle Bone Hair Heart	Mo (ppm): treated: 1.23 control: 0.06 treated: 1.21 control: 0.03 treated: 1.88 control: 1.26 treated: 3.46 control: 0.75 treated: 1.08 control: 0 treated: 0.06 control: 0 treated: 0.37 control: 0 treated: 1.2 control: 0 treated: 0.41 control: 0 Cd (ppm): treated: 0	Bersenyi et al. 1999

Table 1 (Cont'd.)

Species	Location	Number of Animals	Organ/Tissue	Chemical/Concentration	Reference
Rabbit	NA (lab study)	5 per group	Hair	treated: 0 control: 0.36	Bersenyi et al. 1999
				Hg (ppm):	
			Heart	treated: 0 control: 0	
			Lung	treated: 0 control: 0	
			Liver	treated: 3.53 control: 0	
			Kidney	treated: 50.48 control: 0	
			Spleen	treated: 0.08 control: 0	
			Adipose	treated: 0 control: 0	
			Muscle	treated: 0.13 control: 0	
			Bone	treated: 0 control: 0	
			Hair	treated: 0 control: 0	

Table 1 (Cont'd.)

Species	Location	Number of Animals	Organ/Tissue	Chemical/Concentration	Reference
Rabbit	NA (lab study)	5 per group		Se (ppm):	Bersenyi et al. 1999
			Heart	treated: 19.4 control: 0.58	
			Lung	treated: 14.75 control: 0.73	
			Liver	treated: 64.95 control: 1.74	
			Kidney	treated: 38.55 control: 4.1	
			Spleen	treated: 15.35 control: 1.99	
			Adipose	treated: 0.63 control: 0	
			Muscle	treated: 13.49 control: 1.33	
			Bone	treated: 3.21 control: 0	
			Hair	treated: 2.7 control: 1.37	

Table 1 (Cont'd.)

Species	Location	Number of Animals	Organ/Tissue	Chemical/Concentration	Reference
Rabbit	NA (lab study)		Kidney	Cd (background): 0.09 ug/g (Cd-incorp diet) 0.08 ug/g (Cd-amended) 0.06 ug/g (gavage) Cd (high-dose groups): 0.38 ug/g (incorp.) 0.76 ug/g (amended) 0.8 ug/g (gavage)	Chan et al. 2004
Rabbit	NA (lab study)	8 per group	 Kidney Liver Muscle Ovary Uterus	Cd (in mg/kg): control: 0.46 acute: 31.63 chronic: 53.99 chronic + normal diet: 22.5 control: 0.14 acute: 41.31 chronic: 13.2 chronic + normal diet: 3.7 control: 0.1 acute: 0.2 chronic: 0.2 chronic + normal diet: 0.01 control: 0.03 acute: 5.21 chronic: 0.47 chronic + normal diet: 0.25 control: 0.04 acute: 2.59 chronic: 0.25 chronic + normal diet: 0.33	Massanyi et al. 1995

Table 1 (Cont'd.)

Species	Location	Number of Animals	Organ/Tissue	Chemical/Concentration	Reference
Rabbit	NA (lab study)	8 per group	Testes	control: 0.04 acute: 1.93 chronic: 0.1	Massanyi et al. 1995
Rabbit	northern Poland	 28 (1988) 40 (1989) 20 (1990) 30 (1991) 28 (1988) 8 (1989) 10 (1990) 10 (1991) 28 (1988) 5 (1989) 10 (1990) 10 (1991) 28 (1988) 8 (1989) 10 (1990) 10 (1991) 28 (1988) 5 (1989) 10 (1990) 10 (1991) 28 (1988) 8 (1989) 10 (1990) 10 (1991)	 Muscle Liver Kidney Liver Kidney Liver	Hg (ug/g ww): 1.1 (0.5-4) 1.1 (0.4-2.6) 0.9 (0.3-2) 1.2 (0.4-2.4) 2.8 (1.2-5) 2.8 (1.3-7.6) 2.7 (1.2-8.4) 1.6 (1-4.4) 4.9 (1.3-10) 6.9 (4.6-11) 7 (3.1-19) 3.6 (2.4-4.7) Pb (ug/g ww): 0.35 (0.05-1.5) 0.14 (0.07-0.32) 0.23 (0.06-0.51) 0.21 (0.04-1) 0.45 (0.1-1) 0.23 (0.16-0.44) 0.34 (0.12-1.4) 0.18 (0.04-0.23) Cd (ug/g ww): 0.13 (0.047-0.37) 0.065 (0.025-0.19) 0.088 (0.034-0.21) 0.1 (0.04-0.23)	Falandysz et al. 1994

Table 1 (Cont'd.)

Species	Location	Number of Animals	Organ/Tissue	Chemical/Concentration	Reference
Rabbit	Northern Poland	28 (1988) 5 (1989) 10 (1990) 10 (1991) 28 (1988)	Kidney Muscle Liver Kidney Muscle Liver Kidney Muscle Liver Kidney Muscle Liver Kidney	1.1 (0.43-3.2) 1.3 (0.26-1.9) 1.5 (0.29-2.8) 0.74 (0.23-1.7) Mn (mg/kg ww): 0.12 (0.049-0.2) 1.5 (0.51-3.1) 1.7 (1.1-2.6) Cu (mg/kg ww): 0.49 (0.23-1.1) 7 (1.8-23) 6.3 (2.2-21) Fe (mg/kg ww): 15 (3.4-99) 42 (13-78) 53 (32-93) Zn (mg/kg ww): 18 (8.3-37) 58 (34-120) 32 (22-54)	Falandysz et al. 1994
Rabbit	northern Poland	59 30 68 30 68 30	Muscle	Mn: mean 0.11 mg/kg ww (0.04-0.3) Mn: mean 0.11 mg/kg ww (0.034-0.16) Cu: mean 0.57 mg/kg ww (0.2-3.7) Cu: mean 0.58 mg/kg ww (0.33-0.96) Zn: mean 15 mg/kg ww (3.4-39) Zn: mean 17 mg/kg ww (8.9-	Cited in Falandysz 1991 Falandysz 1991 Cited in Falandysz 1991 Falandysz 1991 Cited in Falandysz 1991 Falandysz 1991

Table 1 (Cont'd.)

Species	Location	Number of Animals	Organ/Tissue	Chemical/Concentration	Reference
Rabbit	northern Poland			38)	
		59		Fe: mean 13 mg/kg ww (3.3-39)	Cited in Falandysz 1991
		30		Fe: mean 10 mg/kg ww (5.1-18)	Falandysz 1991
		59		Cd: mean 8 ug/kg ww (<5-47)	Cited in Falandysz 1991
		30		Cd: mean 5 ug/kg ww (<5-18)	Falandysz 1991
		20		Hg: mean 4 ug/kg ww (<1-18)	Cited in Falandysz 1991
		30		Hg: mean <1 ug/kg ww (<1-2)	Falandysz 1991
		68		Pb: mean 130 ug/kg ww (<10-500)	Cited in Falandysz 1991
		30		Pb: mean 20 ug/kg ww (<10-80)	Falandysz 1991
		10	Liver	Mn: mean 0.93 mg/kg ww (0.35-1.4) Cu: mean 3.8 mg/kg ww (2-7.6) Zn: mean 45 mg/kg ww (32-53) Fe: mean 73 mg/kg ww (12-290) Cd: mean 100 ug/kg ww (6-170) Hg: mean 3 ug/kg ww (1-4) Pb: mean 180 ug/kg ww (<10-450)	Falandysz 1991
		10	Kidney	Mn: mean 1.4 mg/kg ww (11-18 *sic*) Cu: mean 3.9 mg/kg ww (2.4-6.6) Zn: mean 30 mg/kg ww (25-37) Fe: mean 53 mg/kg ww (37-85) Cd: mean 1800 ug/kg ww	Falandysz 1991

Table 1 (Cont'd.)

Species	Location	Number of Animals	Organ/Tissue	Chemical/Concentration	Reference
Rabbit	northern Poland			(430-5300) Hg: mean 5 ug/kg ww (1-15) Pb: mean 120 ug/kg ww (40-260)	Falandysz 1991
Rabbit	Alabama	25	Liver	Pb: 1.18 ppm ww (2.64 male, 3.11 female) Cd: 1.05 ppm ww (2.19 male, 2.15 female) Cu: 2.75 ppm ww (2.88 male, 2.58 female) Co: 2.19 ppm ww (2.2 male, 2.16 female) Cr: 2.03 ppm ww (1.99 male, 2.08 female) Ni: 2.4 ppm ww (2.32 male, 2.48 female) Zn: 26.4 ppm ww (24.4 male, 28.88 female)	Khan and Mielke 1998
			Kidney	Pb: 2.98 ppm ww (1.85 male, 3.12 female) Cd: 2.94 ppm ww (3.05 male, 2.57 female) Cu: 2.71 ppm ww (2.73 male, 2.68 female) Co: 2.16 ppm ww (2.13 male, 2.18 female) Cr: 2.04 ppm ww (2.06 male, 2.02 female) Ni: 2.41 ppm ww (2.38 male, 2.42 female) Zn: 24.04 ppm ww (23.34 male, 24.74 female)	

Table 1 (Cont'd.)

Species	Location	Number of Animals	Organ/Tissue	Chemical/Concentration	Reference
Rabbit	Finland	2 1	"Flesh"	Fe: 18 (17-20) mg/kg ww Cu: 1.5 (1-1.9) mg/kg ww Mn: 0.38 (0.26-0.49) mg/kg ww Zn: 17 (16-17) mg/kg ww Co: 30 (20-30) ug/kg ww Cr: 20 (3-30) ug/kg ww Se: 100 (90-120) ug/kg ww Rb: 5.5 (5.2-5.8) mg/kg ww Al: 9 mg/kg ww B: 0.2 mg/kg ww Cd: 20 (5-30) ug/kg ww Pb: 40 (30-60) ug/kg ww As: 0.03 mg/kg ww	Nuurtamo et al. 1980
Rabbit	Not applicable	3 (control group)	Plasma Liver Tibia w/o marrow	Al: mean 0.03 ug/mL approx. Al: mean 4 ug/g approx. Al: mean 20 ug/g ash approx.	Ahn et al. 1995
Rabbit	Slovakia	16 (total)	Kidney Liver Testes Ovary Uterus	Cd: 0.17 mg/kg ww max. Cd: 0.04 mg/kg ww max. Cd: 0.04 mg/kg ww max. Cd: 0.03 mg/kg ww (max.?) Cd: 0.04 mg/kg ww (max.?)	Toman and Massanyi 1996
Rabbit	not reported	not given	Kidney Liver Muscle	Cd: 0.74 mg/kg dw Cd: 0.24 mg/kg Cd: 0.06 mg/kg	Rafay et al. 1987 as cited in Toman and Massanyi 1996
Brown hare	Slovakia	5	Kidney Liver Testes	Cd: 2.05 mg/kg ww max. Cd: 0.36 mg/kg ww max. Cd: 0.007 mg/kg ww (max.?)	Toman and Massanyi 1996
Brown hare	not reported	not given	Kidney	Cd: 2.94 mg/kg	Tataruch 1986 as reported in Toman and Massanyi 1996

Table 2: Squirrel - Metal

Species	Location	Number of Animals	Organ/Tissue	Chemical/Concentration	Reference
Southern flying squirrel	Jefferson National Forest, Virginia	2	Whole body, minus stomach contents	Pb: 7.8 ug/g dw	Goldsmith and Scanlon 1977
Gray Squirrel	Pennsylvania-rural Pennsylvania-suburban	11 10	Hair Hair	Pb: 0.18 ppm Pb: 1.22 ppm	Pratt 1988
Eastern Gray Squirrel	Pennsylvania-rural Pennsylvania-urban	not given	Hair	Pb: 4.31 ppm dw Pb: 11.79 ppm dw	McLaughlin et al. 1981
Richardson's Ground Squirrel	Not given	15	Bone, hair, tissue in path of bullet fragments Hind legs and haunch (no fragments)	Pb: median 3.23 mg (0.01-17.21) Pb: 0.01 mg	Knopper et al. 2006
California Ground Squirrel				Mn:	Bench et al. 2001
	California: B850 location	6	Soil	340 mg/kg (333-345)	
			Liver	8.7 mg/kg	
			Leg muscle	1 mg/kg	
		12	Olfactory bulb (brain)	18 mg/kg	
		6	Soil	239 mg/kg (213-256)	
	California: WOP location		Liver	6 mg/kg	
			Leg muscle	0.9 mg/kg	
		12	Olfactory bulb (brain)	12 mg/kg	
				Cd:	
		6	Soil	0.17 mg/kg (0.132-0.198)	
			Liver	2.3 mg/kg	
	California: B850 location		Leg muscle	0.08 mg/kg	
		12	Olfactory bulb (brain)	5 mg/kg	
		6	Soil	0.07 mg/kg (0.056-0.077)	
			Liver	1.1 mg/kg	
			Leg muscle	0.02 mg/kg	
	California: WOP location	12	Olfactory bulb (brain)	2	

Table 2 (Cont'd.)

Species	Location	Number of Animals	Organ/Tissue	Chemical/Concentration	Reference
Gray Squirrel	Jacksonville, FL		Kidney	Cd:	McKinnon et al. 1976
		<1 y.o.: 75		3.91 ppm ww	
		1 y.o.: 69		9.1 ppm ww	
		2 y.o.: 29		14.93 ppm ww	
		3 y.o.: 10		15.9 ppm ww	
		4 y.o.: 6		15.91 ppm ww	
	Gulf Coast wildlife area	1 y.o.: 5		2.04 ppm ww	
		2 y.o.: 7		4.63 ppm ww	
	Jacksonville, FL			Zn:	
		<1 y.o.: 75		27.72 ppm ww	
		1 y.o.: 69		29.68 ppm ww	
		2 y.o.: 29		30.54 ppm ww	
		3 y.o.: 10		25.99 ppm ww	
		4 y.o.: 6		23.04 ppm ww	
	Gulf Coast wildlife area	1 y.o.: 5		14.32 ppm ww	
		2 y.o.: 7		18.61 ppm ww	
	Jacksonville, FL			Pb:	
		<1 y.o.: 75		1.32 ppm ww	
		1 y.o.: 69		1.28 ppm ww	
		2 y.o.: 29		1.18 ppm ww	
		3 y.o.: 10		0.47 ppm ww	
		4 y.o.: 6		0.86 ppm ww	
	Gulf Coast wildlife area	1 y.o.: 5		0.2 ppm ww	
		2 y.o.: 7		0.26 ppm ww	

Table 2 (Cont'd.)

Species	Location	Number of Animals	Organ/Tissue	Chemical/Concentration	Reference
Arctic Ground Squirrel	Brooks Range, Alaska:	13	Liver		Allen-Gil et al. 1997
	Elusive Lake			As: 0.18 ug/g ww (0.03-1.02)	
				Cd: 0.37 ug/g ww (0.05-1.74)	
				Cu: 5.99 ug/g ww (4.86-7.5)	
				Ni: 0.15 ug/g ww (0.01-1.45)	
				Pb: 0.03 ug/g ww (0.01-0.07)	
		7		Zn: 32.6 ug/g ww (26.85-38.2)	
				Hg: 0.02 ug/g ww (0.01-0.06)	
				Se: 0.26 ug/g ww (0.09-0.56)	
	Feniak Lake				
		13		As: 0.08 ug/g ww (0.03-0.3)	
				Cd: 0.16 ug/g ww (0.02-0.6)	
				Cu: 5.95 ug/g ww (4.08-7.85)	
				Ni: 0.09 ug/g ww (0.03-0.55)	
				Pb: 0.18 ug/g ww (0.01-0.83)	
				Zn: 33.26 ug/g ww (22.2-50.09)	
		8		Hg: 0.05 ug/g ww (0.02-0.08)	
		5		Se: 0.23 ug/g ww (0.17-0.32)	
	Schrader Lake				
		23		As: 0.11 ug/g ww (0.01-0.35)	
				Cd: 0.65 ug/g ww (0.03-4.78)	
				Cu: 6.03 ug/g ww (4.12-8.35)	
				Ni: 0.03 ug/g ww (ND-0.13)	
				Pb: 0.13 ug/g ww (0.02-0.28)	
				Zn: 35.19 ug/g ww (24.75-61.38)	

Table 3: Turkey – Metal

Species	Location	Number of Animals	Organ/Tissue	Chemical/Concentration	Reference
Turkey	not applicable	27 toms	Serum	Zn: 1.93-2.71 ug/mL	Glogowski et al. 2004
Turkey	northern Poland	 20 (1988) 27 (1989) 33 (1990) 28 (1991) 20 (1988) 27 (1989) 24 (1990) 24 (1991) 20 (1988) 21 (1989) 20 (1990) 24 (1991) 24 (1988) 27 (1989) 24 (1990) 24 (1991) 18 (1988) 27 (1989) 19 (1990) 24 (1988) 27 (1989) 24 (1990) 24 (1991)	Muscle Liver Kidney Liver Kidney Liver	Hg (ug/g ww): 6 (0.6-29) 1.7 (0.2-5.9) 0.7 (0.2-1.5) 1.2 (0.6-2.9) 13 (0.3-60) 6.3 (3.6-15) 3.4 (0.8-7.7) 2.9 (1.3-6.2) 11 (3.7-19) 7.7 (5.2-11) 3.7 (1.3-7.5) 3.6 (1.4-8.8) Pb (ug/g ww): 0.09 (0.02-0.25) 0.08 (<0.02-0.14) 0.09 (0.03-0.27) 0.05 (0.01-0.15) 0.14 (0.05-0.31) 0.08 (0.03-0.13) 0.2 (0.06-0.9) Cd (ug/g ww): 0.076 (0.01-0.18) 0.082 (0.029-0.19) 0.091 (0.021-0.32) 0.042 (0.013-0.089)	Falandysz et al. 1994

Table 3 (Cont'd.)

Species	Location	Number of Animals	Organ/Tissue	Chemical/Concentration	Reference
Turkey	northern Poland	18 (1988)	Kidney	0.18 (0.071-0.36)	Falandysz et al. 1994
		27 (1989)		0.24 (0.032-0.42)	
		19 (1990)		0.17 (0.072-0.27)	
		24 (1991)		0.093 (0.047-0.2)	
				Mn (mg/kg ww):	
		24 (1988)	Muscle	0.094 (0.043-0.18)	
		24 (1988)	Liver	1.8 (1.2-2.3)	
		18 (1988)	Kidney	1.6 (1.2-2.3)	
				Cu (mg/kg ww):	
		24 (1988)	Muscle	0.31 (0.21-0.42)	
		24 (1988)	Liver	4.7 (3.1-13)	
		18 (1988)	Kidney	3 (2.3-5.2)	
				Fe (mg/kg ww):	
		24 (1988)	Muscle	4.91 (2.5-8.3)	
		24 (1988)	Liver	59 (29-130)	
		18 (1988)	Kidney	45 (29-56)	
				Zn (mg/kg ww):	
		24 (1988)	Muscle	12 (7.4-24)	
		24 (1988)	Liver	37 (27-72)	
		18 (1988)	Kidney	20 (17-25)	

Table 3 (Cont'd.)

Species	Location	Number of Animals	Organ/Tissue	Chemical/Concentration	Reference
Turkey	northern Poland	8	Muscle	Mn: mean 0.15 mg/kg ww (0.096-0.24) Cu: mean 0.33 mg/kg ww (0.15-0.44) Zn: mean 9.7 mg/kg ww (6.6-14) Fe: mean 32 mg/kg ww (17-55)	Falandysz and Lorenc-Biala 1989 as cited in Falandysz 1991
		7		Hg: mean 6 ug/kg ww (3-9)	Falandysz 1991
		8	Liver	Mn: mean 1.6 mg/kg ww (1.2-2) Cu: mean 2.6 mg/kg ww (1.7-3.8) Zn: mean 28 mg/kg ww (23-37) Fe: mean 78 mg/kg ww (51-110)	Falandysz and Lorenc-Biala 1989 as cited in Falandysz 1991
		7		Hg: mean 8 ug/kg ww (5-10)	Falandysz 1991
Turkey	Finland	2	"Flesh"	Fe: 7.7 (7.6-7.8) mg/kg ww Cu: 0.55 (0.51-0.59) mg/kg ww Mn: 0.11 (0.081-0.14) mg/kg ww Zn: 26 (16-35) mg/kg ww Cr: 10 (3-20) ug/kg ww Se: 50 ug/kg ww Rb: 4.1 (2.6-5.7) mg/kg ww Al: 5 (1-8) mg/kg ww	Nuurtamo et al. 1980

Table 3 (Cont'd)

Species	Location	Number of Animals	Organ/Tissue	Chemical/Concentration	Reference
Turkey hens, photostimulation of egg production	not applicable	week 0: 5	Serum	Ca: 12.92 mg% Zn: 1.64 ug/mL Cu: 0.12 ug/mL Fe: 1.37 ug/mL	Richards 1989
			Liver	Zn: 75 ug/g dw Cu: 15 ug/g dw Fe: 573 ug/g dw	
		week 1: 5	Serum	Ca: 37.82 mg% Zn: 6.88 ug/mL Cu: 0.55 ug/mL Fe: 14.26 ug/mL	
			Liver	Zn: 39 ug/g dw Cu: 8 ug/g dw Fe: 186 ug/g dw	
		week 5: 5	Serum	Ca: 25.62 mg% Zn: 4.93 ug/mL Cu: 0.36 ug/mL Fe: 8.8 ug/mL	
			Liver	Zn: 66 ug/g dw Cu: 11 ug/g dw Fe: 353 ug/g dw	
		week 15 (laying):5	Serum	Ca: 40.6 mg% Zn: 4.59 ug/mL Cu: 0.43 ug/mL Fe: 6.97 ug/mL	
			Liver	Zn: 71 ug/g dw Cu: 12 ug/g dw Fe: 371 ug/g dw	
		week 15 (nonlaying): 5	Serum	Ca: 18.18 mg% Zn: 2.47 ug/mL Cu: 0.2 ug/mL Fe: 1.76 ug/mL	
			Liver	Zn: 87 ug/g dw Cu: 15 ug/g dw Fe: 505 ug/g dw	

Table 4: Rabbits - PCBs

Species	Location	Number of Animals	Organ/Tissue	Chemical/Concentration	Reference
Arctic hare	Arctic Bay, Canada	not given	Fat Liver Muscle	3.4 ug/kg ww 1.4 ug/kg ww 0.4 ug/kg ww	Thomas and Hamilton 1988, as cited in Thomas et al. 1992
Rabbits treated with Fenclor 64 during pregnancy	na	 Dams, preg. day 28: 2 Dams, pp day 5: 2 Dams, pp day 10: 2 Dams, pp day 20: 2 Dams, pp day 40: 2 Fetuses, preg. day 28: 8 Offspring, day 5: 8 Offspring, day 10:8 Offspring, day 20:8 Offspring, day 40:8 Offspring, day 5: 8 Offspring, day 10:8 Offspring, day 20:8	 Fat Fat Fat Fat Fat Whole-body (minus liver) Milk (gastric contents)	total PCBs: 152.1 ug/g 137.1 ug/g 110.4 ug/g 104.1 ug/g 95.5 ug/g 126.4 ug/g 216.8 ug/g 215.2 ug/g 142.2 ug/g 36.2 ug/g 100.7 ug/g 101.9 ug/g 49.1 ug/g	Montesissa et al. 1992

Table 5: Squirrel - PCBs

Species	Location	Number of Animals	Organ/Tissue	Chemical/Concentration	Reference
13-Lined Ground Squirrel	South Dakota	Not given	Liver	Near factory: 8.71 ppm Uncontam. area: 0.41-1.44 ppm	Greichus and Dohman 1980
			Muscle	Near factory: 2.89 ppm Uncontam. area: 0.72-1.11 ppm	
Arctic Ground Squirrels	Brooks Range, Alaska: Elusive Lake				Allen-Gil et al. 1997
		1	Liver	PCB-8: 3.57 ug/g ww	
		2		PCB-28: 0.28 ug/g ww (0.17-0.39)	
		3		PCB-52: 0.71 ug/g ww (0.16-1.14)	
		2		PCB-66: 1.56 ug/g ww (1.16-1.95)	
		5		PCB-87: 0.05 ug/g ww (0.03-0.07)	
		3		PCB-101: 0.22 ug/g ww (0.05-0.38)	
				PCB-105: 0.08 ug/g ww (0.01-0.18)	
				PCB-118: 0.17 ug/g ww (0.06-0.35)	
		2		PCB-128: 0.1 ug/g ww (0.06-0.14)	
		4		PCB-138: 0.48 ug/g ww (0.39-0.62)	
				PCB-153: 0.85 ug/g ww (0.66-1.02)	
				PCB-170: 0.52 ug/g ww (0.36-0.68)	
		2		PCB-180: 0.34 ug/g ww (0.15-0.53)	

Table 5 (Cont'd.)

Species	Location	Number of Animals	Organ/Tissue	Chemical/Concentration	Reference
Arctic Ground Squirrels	Brooks Range, Alaska: Elusive Lake	3	Liver	PCB-187: 0.19 ug/g ww (0.17-0.23)	Allen-Gil et al. 1997
		1		PCB-195: 0.16 ug/g ww	
				PCB-206: 0.05 ug/g ww	
				PCB-209: 0.11 ug/g ww	
				total PCBs: 2.09 ug/g ww	
	Feniak Lake	4	Liver	PCB-8: 18.19 ug/g ww (0.51-48.69)	
		1		PCB-18: 0.19 ug/g ww	
		6		PCB-52: 0.65 ug/g ww (0.27-1.35)	
		1		PCB-66: 0.49 ug/g ww	
		2		PCB-87: 1.71 ug/g ww (0.1-3.33)	
				PCB-101: 0.19 ug/g ww (0.18-0.2)	
				PCB-105: 0.41 ug/g ww (0.3-0.53)	
				PCB-118: 1.2 ug/g ww (0.58-1.83)	
		1		PCB-128: 0.11 ug/g ww	
		10		PCB-138: 1.45 ug/g ww (0.29-2.96)	
		4		PCB-153: 1.96 ug/g ww (0.21-5.62)	
		6		PCB-170: 1.06 ug/g ww (0.44-2.83)	
		4		PCB-180: 1.27 ug/g ww (0.25-3.54)	
		2		PCB-187: 0.17 ug/g ww (0.15-0.19)	
		1		PCB-195: 0.11 ug/g ww	

Table 5 (Cont'd.)

Species	Location	Number of Animals	Organ/Tissue	Chemical/Concentration	Reference
Arctic Ground Squirrels		1		PCB-209: 0.09 ug/g ww	Allen-Gil et al. 1997
		11		total PCBs: 9.72 ug/g ww (1.47-50.04)	
	Schrader Lake		Liver		
		2		PCB-8: 0.48 ug/g ww (0.47-0.49)	
				PCB-18: 1.16 ug/g ww (0.49-1.82)	
		3		PCB-28: 0.56 ug/g ww (0.07-1.3)	
				PCB-52: 0.2 ug/g ww (0.2-0.21)	
		2		PCB-87: 3.09 ug/g ww (0.4-5.79)	
		16		PCB-138: 3.53 ug/g ww (0.09-12.25)	
				PCB-170: 3.53 ug/g ww (0.09-12.25)	
		2		PCB-180: 0.13 ug/g ww (0.08-0.18)	
		1		PCB-187: 0.14 ug/g ww	
		10		total PCBs: 5.72 ug/g ww (0.74-12.74)	
	Elusive Lake		Fat		
		1		PCB-87: 0.1 ug/g ww	
				PCB-105: 0.2 ug/g ww	
				PCB-118: 0.5 ug/g ww	
				PCB-128: 0.2 ug/g ww	
		2		PCB-138: 0.4 ug/g ww (0.4-0.5)	
				PCB-153: 0.5 ug/g ww (0.4-0.6)	
		1		PCB-170: 0.2 ug/g ww	
		2		PCB-180: 0.3 ug/g ww (0.2-0.5)	

Table 5 (Cont'd.)

Species	Location	Number of Animals	Organ/Tissue	Chemical/Concentration	Reference
Arctic Ground		1		PCB-187: 0.1 ug/g ww	Allen-Gil et al. 1997
Squirrels		2		PCB-206: 0.1 ug/g ww	
	Feniak Lake		Fat		
		3		PCB-105: 2.4 ug/g ww (0.5-4.3)	
		2		PCB-118: 5 ug/g ww (0.7-12.9)	
		10		PCB-128: 1.3 ug/g ww (1.1-1.6)	
				PCB-138: 4.2 ug/g ww (nd-18.4)	
		2		PCB-153: 13.6 ug/g ww (0.4-62.6)	
		11		PCB-170: 6.8 ug/g ww (1.7-12)	
		2		PCB-180: 9 ug/g ww (0.2-15.5)	
		1		PCB-187: 0.4 ug/g ww (0.3-	
		4		0.4)	
		2		PCB-195: 1.9 ug/g ww	
				PCB-206: 1.1 ug/g ww (0.1-3)	
				PCB-209: 0.4 ug/g ww (0.3-	
		5		0.5)	
	Schrader Lake		Fat		
		2		PCB-138: 0.5 ug/g ww (0.3-1.1)	
		4		PCB-153: 1.3 ug/g ww (1.3-1.4)	
		1		PCB-180: 0.6 ug/g ww (0.2-0.9)	
				PCB-187: 0.1 ug/g ww	

Table 6: Turkey – PCBs

Species	Location	Number of Animals	Organ/Tissue	Chemical/Concentration	Reference
Turkey samples (market)	NA	not given	not given	1-39 pg/g (varied by congener), fresh wt basis 20-893 pg/g (varied by congener), lipid-corrected	Sandell and Kokkonen 2003
Turkeys	Illinois	30 12	Fat	nd-17 ppm nd-5.1 (Congeners similar to mixture of Aroclor 1254/1260)	Hansen et al. 1989

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